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INCLUSIVE SPECTRA OF HADRON RESONANCES IN THE FRAMEWORK OF MULTIPARTON RECOMBINATION MODEL:

2. PION AND KAON FRAGMENTATION

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ՀԱԴՐՈՆԱՅԻՆ ՌԵԶՈՆԱՆՍՆԵՐԻ ԻՆԿԼՅՈՒԶԻՎ ՍՊԵԿՏՐԵՐԸ, ԲԱԶՄԱՊԱՐՏՈՆԱՅԻՆ ՎԵՐԱՄԻԱՎՈՐՄԱՆ ՄՈԴԵԼԻ ՇՐՋԱՆԱԿՆԵՐՈՒՄ

Ի. ՊԻՈՆԻ ԵՎ ԿԱՈՆԻ ՀԱՏՎԱԾԱՎՈՐՈՒՄԸ

Բազմապարտոնային մոդելի շրջանակներում ստացվել են մեզոնային և բարիոնային ռեզոնանսում պիոնի և կաոնի ,,ուղիղ,, հատվածավորման ինկլյուզիվ սպեկտրերը: Մոդելի կանխատեսումների և փորձնական տվյալների համեմատությունից գնահատականներ են ստացվել պիոնում և կաոնում ծովային պարտոնների բաշխման պարամետրերի համար: Ստացվել է մեզոնային ρ^0, φ, $K^{\pm 0}$/890/, $K^{\pm 0}$/1430/ և հակաբարիոնային $\bar{\Sigma}^{\pm}$/1380/ ռեզոնանսների ռում Ֆեյնմանի x փոփոխականի լայն տիրույթի, ինչպես նաև $\Sigma^{\pm}$/1385/, Δ^{++}/1232/ բարիոնային ռեզոնանսների $x > 0,4$ բարձր էներգիաների դեպքում, պիոնի և կաոնի հատվածավորման տիրույթում πp և Kp փոխազդեցություններում ինկլյուզիվ սպեկտրերի բավարար նկարագիրը:

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Н.Н.БАДАЛЯН, Р.Г.БАДАЛЯН, Г.Р.ГУЛКАНЯН

ИНКЛЮЗИВНЫЕ СПЕКТРЫ АДРОННЫХ РЕЗОНАНСОВ В РАМКАХ МНОГОПАРТОННОЙ РЕКОМБИНАЦИОННОЙ МОДЕЛИ

II. ФРАГМЕНТАЦИЯ ПИОНА И КАОНА

В рамках многопартонной рекомбинационной модели получены инклюзивные спектры "прямой" фрагментации пиона и каона в мезонные и барионные резонансы. Из сравнения предсказаний модели с экспериментальными данными получены оценки для параметров распределения морских партонов в пионе и каоне. Получено удовлетворительное описание инклюзивных спектров мезонных ρ^0 , φ , $K^{\pm 0}$ (890) , $K^{\pm 0}$(1430) и антибарионного $\bar{\Sigma}^{\pm}$ (1385) резонансов в широкой области по фейнмановской переменной x , а также барионных резонансов $\Sigma^{\pm}$(1385), Δ^{++}(1232) при $x > 0,4$ в области фрагментации пиона и каона в πp - и Kp - взаимодействиях при высоких энергиях.

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INCLUSIVE SPECTRA OF HADRON RESONANCES IN THE FRAMEWORK OF MULTIPARTON RECOMBINATION MODEL:

2. PION AND KAON FRAGMENTATION

Inclusive spectra of "direct" fragmentation of pion and kaon into meson and baryon resonances are obtained in the framework of multiparton recombination model. The parameters of distribution of sea partons in pion and kaon are estimated from the comparison of model predictions with the experimental data. Satisfactorily are described the inclusive spectra of meson ρ^0 , φ , $K^{\pm *}(890)$, $K^{\pm,0}(1430)$ and antibaryon $\bar{\Sigma}^{\pm}(1385)$ resonances in a wide range over the Feynman variable x , and also baryon resonances $\Sigma^{\pm}(1385)$, $\Delta^{++}(1232)$ at $x > 0.4$ in the fragmentation region of pion and kaon in πP- and KP-interactions at high energies.

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Yerevan 1986

§1. Introduction

In Ref. [1] , on the basis of earlier suggested [2,3] multiparton recombination model (MRM), there have been satisfactorily described the experimental data on inclusive spectra of baryon and meson resonances in the fragmentation region of proton in its interactions with high-energy hadrons ($\geqslant$ 30 GeV/c). In MRM the shape of inclusive spectra (over the Feynman variable X) in the direct fragmentation of proton into hadron resonances is fully determined: a) by distribution functions of partons (valence and sea ones) in proton taken from experiments on deep inelastic lepton-nucleon scattering; b) by distribution functions of valons (constituent quarks) in the final hadron; c) by the probability W of a sea parton of incident proton being included in the sea of the final hadron. In Refs. [2,3] it has been shown that W is determined by the number of valence quarks N_v common for the incident proton and final hadron: at $N_v=3$ $W\sim 1$, at $N_v=2$ $W\sim 2/3$, at $N_v=1$ $0\leqslant W<1/3$, at $N_v=0$ $W\sim 0$. As mentioned in Ref. [1], the details in the valon distribution in the final hadron do not strongly affect the shape of the inclusive spectrum, that is why these distributions are given (see also Refs. [4-6]) in analogy with valon distribution functions of proton (for baryon resonances), of pion (for nonstrange meson resonances) and of kaon (for strange meson resonances).

We have much poorer information on the parton distribution functions in pion and kaon than in nucleon. We have data (obtained in the experiments on Drell-Yan pair production) only on the distribution of valence quarks (antiquarks) in pion, and of nonstrange valence quarks (antiquarks) in kaon; to get information on the distribution of sea partons (quarks, antiquarks, gluons) by investigating hard processes in pion and kaon beams seems to be a problem not practically feasible. That is why attempts are made [7,8] to get such information by using quark-parton models to describe hadron processes with small transverse momenta.

The aim of the present work is to apply the MRM to fragmentation processes of π- and K-mesons into hadron resonances and extract the parameters of parton distribution functions for pion and kaon from the comparison with the experiment. Consideration of production processes of the very hadron resonances stems from the fact that their inclusive spectra reflect more directly the structural peculiarities of the particle fragmented, than do the inclusive spectra of stable particles involving quite a contribution from decays of resonances. In §2, on the basis of the Kuti-Weisskopf model [9] and using data on Drell-Yan pair production [10] in pion and kaon beams the valence part of structure functions of π- and K-mesons is fixed, and their two-valon distribution functions are determined. In §3 the parameters of distribution of sea partons in pion and kaon are estimated by comparing the MRM predictions with the available experimental data on production of meson and baryon resonances in the fragmentation region of incident pion (kaon); satisfactory agreement of calculations with the experiment being provided.

§2. Distribution of Partons and Valons in π – and K-Mesons

We shall use the multiparton distribution function proposed in the Kuti-Weisskopf model 9 to describe distributions of valence quarks and sea partons in meson $M(q_1,q_2)$ ($q_i, i=1,2$ – – quark or antiquark). According to this model the distribution densities for valence $q(x)$ and sea $a_s(x)$ partons have the form:

$$q_1(x) = x^{-1+\beta_{q_1}}(1-x)^{-1+\beta_{q_2}+\gamma_M} B^{-1}(\beta_{q_1}, \beta_{q_2}+\gamma_M) \tag{1a}$$

$$q_2(x) = x^{-1+\beta_{q_2}}(1-x)^{-1+\beta_{q_1}+\gamma_M} B^{-1}(\beta_{q_2}, \beta_{q_1}+\gamma_M) \tag{1b}$$

$$a_s(x) = g_a x^{-1}(1-x)^{-1+\beta_{q_1}+\beta_{q_2}+\gamma_M} \tag{1c}$$

where $a = u,\bar{u},d,\bar{d},s,\bar{s},G$ is the sea parton kind (sort) (contributions of heavier sea quarks are not considered), $\gamma_M = \sum_a g_a$, $B(x,y)$ is Euler's beta function. Parameters β_q, characterizing the behaviour of structure functions at $x \to 0$, are equal [11,12] for the valence quarks of pion and for the nonstrange valence quark of kaon $-\beta^{\pi}_{u(d)} = \beta^{K}_{u(d)} = 0.5$, and for the strange one – $\beta^{K}_{s} = 1$. Parameters γ_M can be estimated from the data on the Drell-Yan lepton pair production in pion and kaon beams [10] : $\gamma_{\pi} = 1.6$ and $\gamma_K =$ 1.2 [illegible] sions (1) for pion will read:

$$q^{\pi}_{u(d)}(x) = 0{,}77\,x^{-0{,}5}\,(1-x)^{1{,}1} \tag{2a}$$

$$a^{\pi}_{s}(x) = g^{\pi}_{a}\,x^{-1}\,(1-x)^{1{,}6} \tag{2b}$$

for kaon

$$q^{K}_{u(d)}(x) = 0{,}81\,x^{-0{,}5}(1-x)^{1{,}3} \tag{3a}$$

$$q^{K}_{s}(x) = 1{,}8\,(1-x)^{0{,}8} \tag{3b}$$

$$a^{K}_{s}(x) = g^{K}_{a}\,x^{-1}(1-x)^{1{,}8} \tag{3c}$$

It follows from (2) and (3) (see also Refs. [11,12]) that the valence quarks in pion carry on an average $\bar{x}_{u(d)} = \beta^{\pi}_{u(d)}/(\beta^{\pi}_{u}+\beta^{\pi}_{d}+\gamma_{\pi}) = 0.19$, sea partons - 0.62 of the pion longitudinal momentum; in kaon the nonstrange and strange quarks carry on an average $\bar{x}^{K}_{u(d)} = \beta^{K}_{u(d)}/(\beta^{K}_{u(d)}+\beta^{K}_{s}+\gamma_{K}) = 0.18$ and $\bar{x}^{K}_{s} = \beta^{K}_{s}/(\beta^{K}_{u(d)}+\beta^{K}_{s}+\gamma_{K}) = 0.36$, respectively, sea partons - 0.46 of the kaon longitudinal momentum. The unknown in Eqs.(2b) and (3c) parameters g^{π}_{a} (g^{K}_{a}) , characterizing the mean portions of momenta carried by sea partons of the given kind (a = u,ū,d,d̄,s,s̄, G) in pion (kaon), will be estimated in the following paragraph by comparison of MRM predictions with the experimental data on inclusive cross sections of production of hadron resonances.

The Kuti-Weisskopf model allows to calculate also the x-distribution of any multiparton subsystem as a whole [2,3] . A particular case of such a subsystem in meson is valon which contains one of the valence quarks and on an average $W = 1/2$ part of sea partons of meson (the probability of the given sea parton to belong to valon is $W = 1/2$). Valon distribution densities, calculated in analogy with Refs. [1-3], in meson have the form:

$$Q_1(x) = x^{-1+\beta_{q_1}+\gamma_M/2}(1-x)^{-1+\beta_{q_2}+\gamma_M/2}B^{-1}(\beta_{q_1}+\gamma_M/2,\beta_{q_2}+\gamma_M/2) \qquad (4a)$$

$$Q_2(x) = x^{-1+\beta_{q_2}+\gamma_M/2}(1-x)^{-1+\beta_{q_1}+\gamma_M/2}B^{-1}(\beta_{q_2}+\gamma_M/2,\beta_{q_1}+\gamma_M/2) \qquad (4b)$$

Q_i $(i = 1,2)$ designates a valon which contains q_i valence quark . If the mean momenta carried by valons in pion are equal to 0.5, then in kaon the nonstrange valon will carry on an average $\bar{X}^K_{u(D)} = (\beta^K_{u(d)} + \gamma_K/2)/(\beta^K_{u(d)} + \beta^K_s + \gamma_K) = 0.41$, and the strange valon - $\bar{X}^K_s = (\beta^K_s + \gamma_K/2)/(\beta^K_{u(d)} + \beta^K_s + \gamma_K) = 0.59$ of the longitudinal momentum of kaon. The ratio $\bar{X}^K_s/\bar{X}^K_{u(D)} = 1.4$ is close to that used in the additive quark model [13] and can be interpreted [4-6, 11-13] as a result of difference in masses of strange and nonstrange valons.

Distributions of valence quark-partons and valons for pion and kaon are shown in Fig.3. The valon distributions obtained in this paper considerably differ from the analogous distributions in the additive quark model [13] (also shown in Fig.3) and practically coincide with those obtained from mesons form-factor analysis [5,6].

§3. Comparison with the Experiment

In MRM the invariant inclusive cross sections $f(x) = \frac{1}{\pi}\times\int\frac{E}{p_{max}}\frac{d^2\sigma}{dx\,dp_T^2}dp_T^2$ of production of direct hadrons h in the fragmentation region of incident meson M have the following form [1] :

$$\frac{\pi}{\sigma_{inelast}} f(x) = \sum_{N_v=0}^{N_v^{max}} \int F_{V_1 \ldots V_{N_h}}(x_1, \ldots, x_{N_h}; W_1, \ldots, W_{N_h}) \times$$
$$\times R_h\left(\frac{x_1}{x}, \ldots, \frac{x_{N_h}}{x}\right) \delta\left(1 - \sum_{j=1}^{N_h} \frac{x_j}{x}\right) \prod_{j=1}^{N_h} dx_j \qquad (5)$$

Summation in (5) over N_v means that to the inclusive spectrum of hadron h contribute processes where from incident meson into h hadron pass from $N_v = 0$ to $N_v = N_v^{max}$ valence quarks, where N_v^{max} is the maximum possible number of valence quarks common for incident meson and final hadron.

The function $F_{V_1 \ldots V_{N_h}}(x_1, \ldots, x_{N_h}; W_1, \ldots, W_{N_h})$ characterizes the statistical weight of the meson multiparton substate, which has the same quark composition ($V_1, \ldots, V_{N_h}$) and longitudinal momentum x as the hadron h ($N_h = 2$ if h is a meson, $N_h = 3$ if h is an (anti-)barion), and which contains on an average $W = \sum_{j=1}^{N_h} W_j$ part of sea partons of meson. A hypothesis is used in MRM, according to which the recombination of multiparton substate into final hadron is preceded by formation of constituent object-valons $V_1, \ldots, V_{N_h}$ which correspondingly carry portions of $x_1/x, \ldots, x_{N_h}/x$ longitudinal momentum of this substate [1]. Parameters $W_1, \ldots, W_{N_h}$ determine the probabilities with which the substate parton sea is distributed between $V_1, \ldots, V_{N_h}$ valons. The function $F_{V_1 \ldots V_{N_h}}(x_1, \ldots, x_{N_h}; W_1, \ldots, W_{N_h})$ is expressed [1] in terms of parameters of parton distribution functions in meson (1). In Refs.[2, 3] is shown, that in diffraction-type process (e.g. p→p, $\pi^{\pm} \to \pi^{\pm}$, $K^{\pm} \to K^{\pm}$ etc), when all valence quarks of incident hadron must be included in the multiparton substate (i.e.

in case of an incident meson $N_v = N_v^{max} = N_h = 2$), then $W \approx 1$, that is to say, practically the whole sea passes to the final hadron, and in this case $W_1 = \dots = W_{N_h} = W/N_h$. In case of $N_v=0$, i.e. none of valence quarks is included in the multiparton state, and in the final hadron occur N_h sea quarks (antiquarks) of incident hadron, then $W \approx 0$ ($W_1 = \dots = W_{N_h} = 0$). In case of $N_v = 1$, W can be other than zero; it being assumed [1], that $W_1 = W$ for valon containing a valence quark of incident hadron and $W_j = 0$ ($j \neq 1$) for other valons which do not contain a valence quark of incident hadron; the value of W will be later determined from the comparison of (5) with the experiment. Expressions of functions $F_{v_1 \cdots v_{N_h}}(x_1, \dots, x_{N_h}; W_1, \dots, W_{N_h})$ for processes $\pi, K \to h$ considered in this paper, are presented in the Appendix.

The so-called recombination functions in the Eq.(5) are expressed [1-6] in terms of two-(three-)valon distribution functions of meson (baryon) h :

$$R_h(z_1, \dots, z_{N_h}) = A_h\Big(\prod_{j=1}^{N_h} z_j\Big) G_h(z_1, \dots, z_{N_h}) \qquad (6)$$

Expressions for G_h are given in the Appendix too. Coefficients A_h in Eq.(6) characterize the relative probabilities of recombination of multiparton state into hadrons from different multiplets. In case of proton fragmentation into vector mesons from the lowest nonet (ρ , K(890), the coefficient A_h appeared to be close to unity: $A_M = 1$ [1]. Further, we shall fix this value also for processes π , $K \to M^*$ ($M^* = \rho$, K(890), φ), and the degree of suppression of meson production from the higher multiplets (in particular, of tensor meson K(1430)) and of baryon resonance production (in particular, from the lowest decuplet of baryons (antibaryons) Δ (1232), Σ (1385), $\bar{\Sigma}$ (1385)) will be determined from comparison with the experiment. Below are given the obtained from the Eq.(5) general analytical expressions for non-diffraction ($N_v \leqslant 1$) meson fragmentation into meson and baryon resonances. In case of fragmentation of meson $M(q_1,q_2)$ into meson resonance $M^*(q_1,a)$, containing the valence quark q_1 of incident meson ($N_v = 1$):

$$\frac{\pi}{\sigma_{inelast}} f^{N_v=1}_{M\to M^*}(x) = g_a x^{\beta_{q_1}+W\gamma_M}(1-x)^{-1+\beta_{q_2}+(1-W)\gamma_M} \times \frac{B(\beta_{q_1}+W\gamma_M+\alpha_{q_1}+1,\alpha_a+1)}{B(\beta_{q_1}+W\gamma_M,\beta_{q_2}+(1-W)\gamma_M)B(\alpha_{q_1}+1,\alpha_c+1)} \tag{7a}$$

In case of fragmentation of meson $M(q_1,q_2)$ into meson resonance $M^*(a,b)$ which does not contain a valence quark of incident meson ($N_v = 0$):

$$\frac{\pi}{\sigma_{inelast}} f^{N_v=0}_{M\to M^*}(x) = g_a g_b (1-x)^{-1+\beta_{q_1}+\beta_{q_2}+\gamma_M} \tag{7b}$$

In case of fragmentation into a (anti-)baryon resonance $B^*(q_1,a,b)$ containing a valence (anti-)quark of incident meson q_1 ($N_v = 1$):

$$\frac{\pi}{\sigma_{inelast}} f^{N_v=1}_{M\to B^*}(x) = g_a g_b x^{\beta_{q_1}+W\gamma_M}(1-x)^{-1+\beta_{q_2}+(1-W)\gamma_M} \times \frac{B(\beta_{q_1}+W\gamma_M+\alpha_{q_1}+1,\alpha_a+1,\alpha_b+1)}{B(\beta_{q_1}+W\gamma_M,\beta_{q_2}+(1-W)\gamma_M)B(\alpha_{q_1}+1,\alpha_a+1,\alpha_b+1)} \tag{8a}$$

where $B(x,y,z)=\Gamma(x)\Gamma(y)\Gamma(z)/\Gamma(x+y+z)$, $\Gamma(x)$ is Euler's gamma function. In case of fragmentation into (anti-)baryon resonance $B^*(a,b,c)$ which does not contain valence (anti-)quark of incident meson:

$$\frac{\pi}{\sigma_{inelast}} f^{N_v=0}_{M\to B^*}(x) = g_a g_b g_c (1-x)^{-1+\beta_{q_1}\cdot\bar{\beta}_{q_2}+\gamma_M} \qquad (8b)$$

In Figs.4-9 the obtained by means of Eqs.(7) and (8) inclusive spectra are compared with the experimental data on meson resonances ρ^0 , φ , K(890), K(1430) and baryon (antibaryon) resonances Δ (1232), Σ (1385), $\bar{\Sigma}$ (1385) production at energies more than 30 GeV, involving quite a wide range over x in the fragmentation region of incident kaon (pion). Satisfactory agreement with the data on fragmentation into vector mesons (with the highest statistics, Figs.4,5,7) is achieved at $W = 0.2 \pm 0.1$. It means, that in subprocesses with $N_v = 1$ the valence quark, passing from an incident meson to a final one, partially looses its "cloud" of sea partons. Note, that in Eqs. (7) and (8) the use of the value of $W = 0$ (i.e. the valence quark entirely looses its "cloud", as proposed in recombination models developed earlier [27-28]) or $W = 0.5$ (the valence quark has its whole "cloud" around it, as suggested in the additive quark model [13]) leads to disagreement of MRM predictions with the set of experimental data shown in Figs.4-9.

The values of parameters g^K_a , at which the curves (on kaon fragmentation) shown in Figs.4-10 are calculated, are presented in the Table.

The suppression factor λ_K of kaon strange sea with respect to the nonstrange one (in MRM λ_K is determined, in particular, by relations between inclusive cross sections of processes $K \rightarrow \varphi$ and $K \rightarrow K(890)$ at large x) is obtained to be $\lambda_K = 2g_s^K/(g_u^K + g_d^K) = 0.24$. Comparison with the experiment for the process $\pi \rightarrow \rho^0$, and also predictions for inclusive spectra of $\pi \rightarrow \rho^{\pm}$ are shown in Figs.4a,10 at the value of parameter g_a^{π} for nonstrange sea $g_u^{\pi} = g_d^{\pi} = 0.31$ (see the Table). The parameter g_s^{π} and, consequently, the suppression factor λ_{π} can not be determined at present because of the lack of data (at high energies) on fragmentation of pion into mesons containing a strange quark. Note, that the change of the parameters given in the Table by less than 20-25% does not considerably deteriorate the agreement between the calculations and the experiment.

Comparison of theoretical spectra of the process $K \rightarrow K(1430)$ (at parameters g_a^K given in the Table) with the experiment has shown that $A_h = A_{K(1430)} = 1/2$ (Fig.6) which characterizes the degree of suppression of tensor meson production with respect to the vector ones. In the spectrum of K(890), besides the direct production, contribution of $K(1430) \rightarrow K(890)\pi$ decays is taken into account; unessential contribution of $K(1430) \rightarrow K(890)\pi\pi$ decays is ignored. In calculations is also ignored the possible minor contribution [20,22] of decay of the highest resonances produced at diffraction excitations of incident meson.

The Eq.(8) at parameters g_a , given in the Table, well describes the x-dependence of the inclusive spectrum of antibaryon resonances ($\overline{\Sigma}$ (1385), Fig.8), and agreement with the value of inclusive cross section is achieved at the proportionality coefficient of $A_h = A_B = 1/4$ which characterizes the suppression of meson fragmentation into baryon-antibaryon pair with respect to meson fragmentation into mesons of vector multiplet. In Figs.8,9 calculations are compared with the experiment on baryon resonances $\Sigma^{\pm}(1385)$, $\Delta^{++}(1232)$ at a given A_B. At large x the experimental data in all agree with the theoretical curve, while in the region of $x < 0.4$ there is observed a noticeable excess of experiment over calculation which is due to contribution of the high-energy part of the recoil baryon spectrum in the meson-proton interaction.

Thus, the MRM in all satisfactorily describes the experimental data on meson fragmentation into hadron resonances.

The further storage and checking of experimental data on production of hadron resonances and simultaneous analysis in the MRM framework of inclusive spectra of stable hadrons and hadron resonances in the fragmentation region of π- and K-mesons will allow to estimate more accurately parameters of parton distributions of these mesons.

Appendix

Functions $F_{V_1 \ldots V_{N_h}}(x_1, \ldots, x_{N_h}; W_1, \ldots, W_{N_h})$ and $G_h(z_1, \ldots, z_{N_h})$ in Eqs.(5) and (6) for inclusive cross sections of different fragmentation processes of $M(q_1,q_2) \to h$ have the following form:

A) Meson $M(q_1,q_2) \to$ meson processes: $x = x_1+x_2$

1. $N_V = 1$, on valence q_1 quark (antiquark), $W_1 = W = 0.2$, $W_2 = 0$

$$F_{Q_1A}(x_1,x_2;W,0) = g_a (1-x)^{-1+\beta_{q_2}+(1-W)\gamma_M} x_1^{-1+\beta_{q_1}+W\gamma_M} x_2^{-1} \times \tag{App.1a}$$

$$\times B^{-1}(\beta_{q_1}+W\gamma_M, \beta_{q_2}+(1-W)\gamma_M)$$

2. $N_V = 0$, $W_1 = W_2 = 0$

$$F_{AB}(x_1,x_2;0,0) = g_a g_B (1-x)^{-1+\beta_{q_1}+\beta_{q_2}+\gamma_M} (x_1 x_2)^{-1} \tag{App.1b}$$

The two-valon distribution in meson $M^*(a,\bar{b})$ (where $a,b = u,d,s$) has the form (see 3a , 3b):

$$G_{M^*}(z_1,z_2) = z_1^{\alpha_a} z_2^{\alpha_B} B^{-1}(\alpha_a+1, \alpha_B+1) \tag{App.2}$$

where $\alpha_q = -1+\gamma_M/2+\beta_q$; $\gamma_M = 1{,}6$

B) Meson $M(q_1,q_2) \to$ (anti-)baryon processes: $x = x_1+x_2+x_3$

1. $N_V = 1$, on valence q_1 quark (antiquark), $W_1 = W = 0.2$, $W_2 = W_3 = 0$

$$F_{Q_1AB}(x_1,x_2,x_3;W,0,0) = g_a \overline{g_B} (1-x)^{-1+\beta_{q_2}+(1-W)\gamma_M} x_1^{-1+\beta_{q_1}+W\gamma_M} (x_2 x_3)^{-1} \times \tag{App.3a}$$

$$\times B^{-1}(\beta_{q_1}+W\gamma_M, \beta_{q_2}+(1-W)\gamma_M)$$

2. $N_v = 0,\ W_1 = W_2 = W_3 = 0$

$$F_{ABC}(x_1,x_2,x_3;0,0,0) = g_a g_b g_c (1-x)^{-1+\beta_{q_1}+\beta_{q_2}+\gamma_M} (x_1 x_2 x_3)^{-1} \qquad \text{(App.3b)}$$

The three-valon distribution in baryon $B^*(a,b,c)$ has the following form ($z_1 + z_2 + z_3 = 1$):

$$G_{B*}(z_1,z_2,z_3) = z_1^{\alpha_a} z_2^{\alpha_b} z_3^{\alpha_c} B^{-1}(\alpha_a+1,\alpha_b+1,\alpha_c+1) \qquad \text{(App.4)}$$

where $\alpha_q = -1 + \gamma_B/3 + \beta_q$; $\gamma_B = 3{,}51 \div 3{,}54$, $\beta_{u(d)} = 0{,}5$, $\beta_s = 1$ [1]

$B(x,y,z) = \Gamma(x)\Gamma(y)\Gamma(z)/\Gamma(x+y+z)$ where $\Gamma(x)$ is Euler's gamma function.

Table

M	$g_{u(\bar u)} = g_{d(\bar d)}$	$g_{s(\bar s)}$	g_G	$\gamma = \sum_a g_a$
K	0.25	0.06	0.18	1.3
π	0.31	$0.31\,\lambda_\pi$	$0.36-0.62\,\lambda_\pi$	1.6

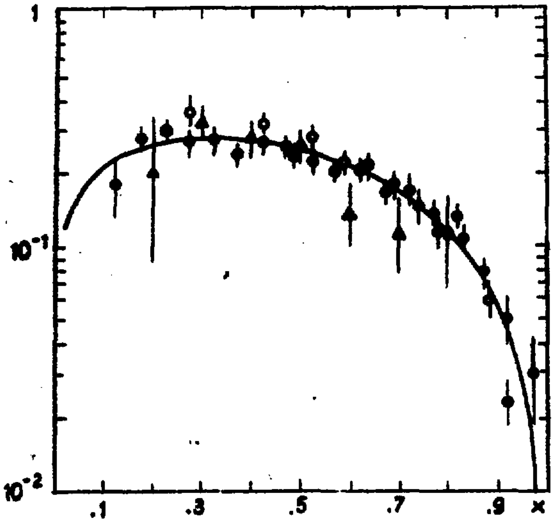


Fig.1 Distribution function of valence quark in π -meson determined by $\mu^+\mu^-$ - pair production in πp - interactions: ● - NA3, 200 GeV/c; o - CIP, 225 GeV/c; Δ -GOLIATH, 175 GeV/c [10]. The curve is calculated by the formula (2a).

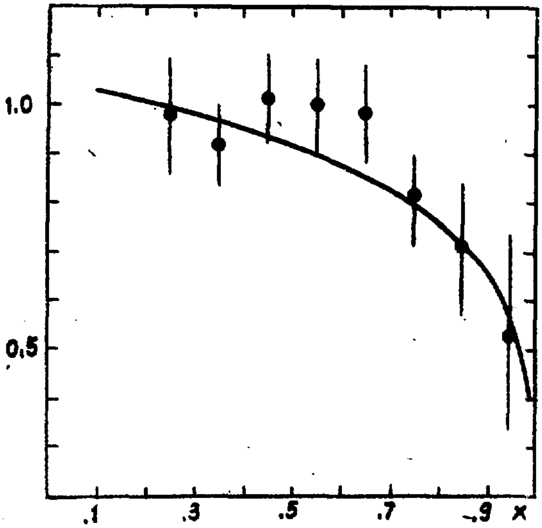


Fig.2 The ratio of distribution functions of the nonstrange valence quark of kaon and valence quark of pion [10]. The curve is calculated by the formulae (2a) and (3a).

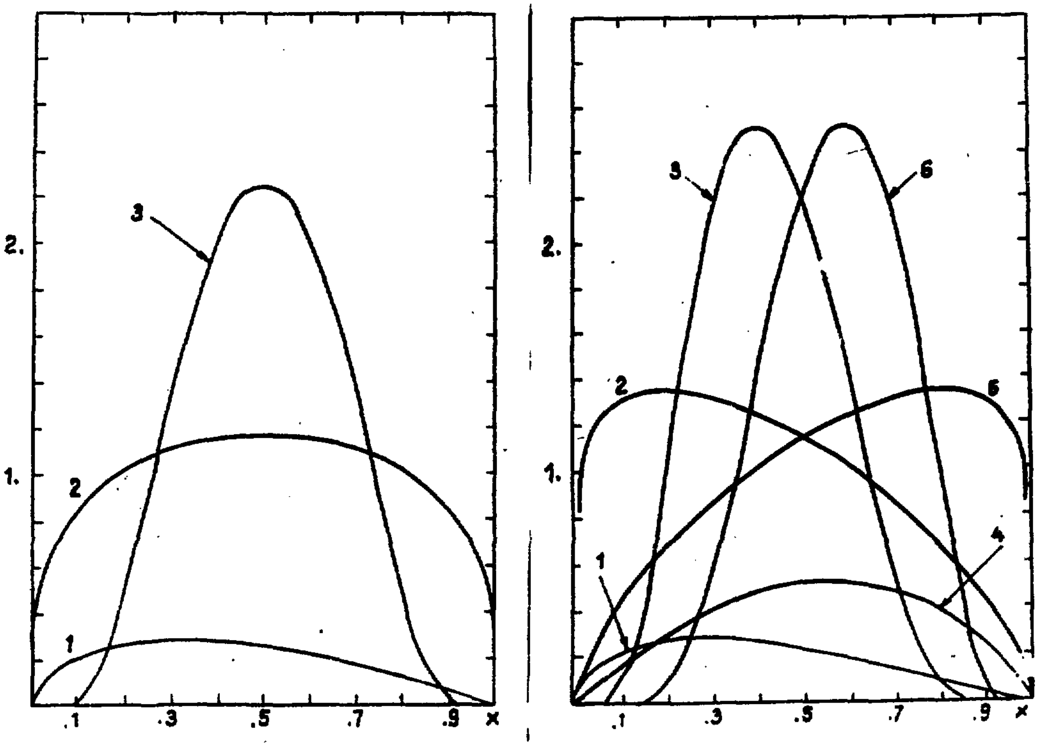


Fig.3 Distribution of valence quarks xq(x) and valons Q(x) in π (a) and K(б) mesons.

a) Curve 1 - the valence quark of π -meson, curve 2 - the valon in π - meson (coincides with the distribution determined in Refs.[5,6]), curve 3 - the distribution of constituent quark (valon) in the additive quark model [13].

b) Curve 1(4) - nonstrange (strange) valence quark in K-meson; curve 2(5) - nonstrange (strange) valon in K-meson; curve 3(6) - nonstrange (strange) constituent quark in the additive quark model [13] .

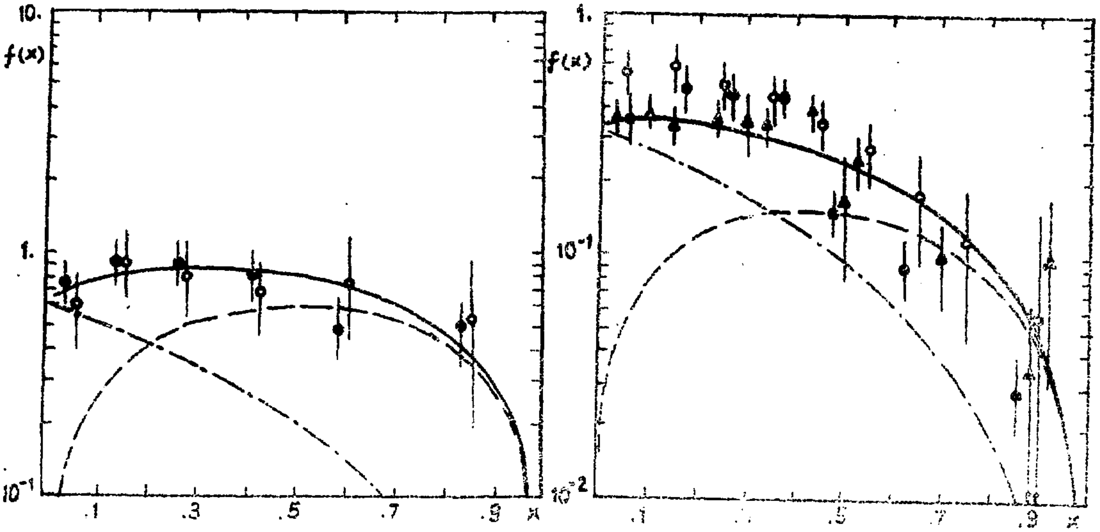


Fig.4 Inclusive spectrum of ρ^0-meson in the fragmentation region of π (a)- and K(б)-mesons. The calculated curves correspond to fragmentation processes at the number of common valence quarks $N_v = 1$ (dashed curve), $N_v=0$ (dot-and-dash curve); the solid curve is the total spectrum.

a) $\pi^+ \xrightarrow{p} \rho^0$: ● - 147 GeV/c 14 ; $\pi^- \xrightarrow{p} \rho^0$: ○ - - 147 GeV/c [14] .

b) $K^+ \xrightarrow{p} \rho^0$: ● - 32 GeV/c [15], ▲ - 70 GeV/c [16]; $K^- \xrightarrow{p} \rho^0$: ○ - 32 GeV/c [17], Δ - 110 GeV/c [18].

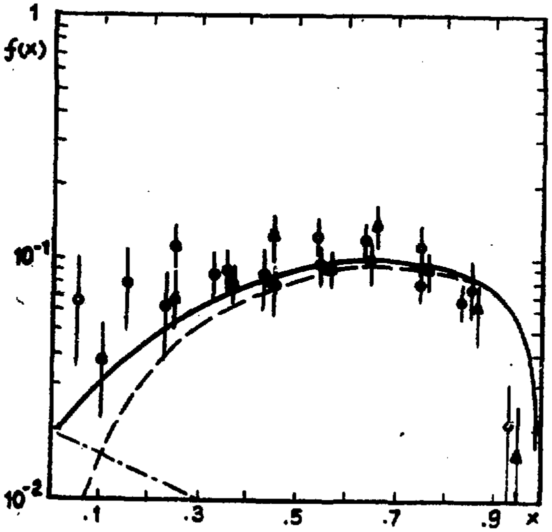
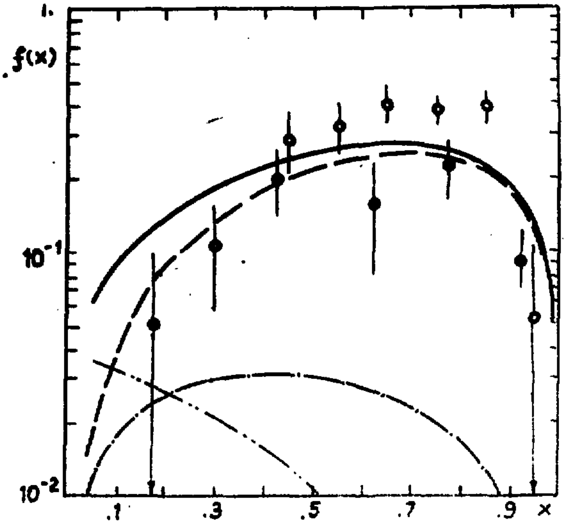


Fig.5 Inclusive spectrum of φ-meson in the fragmentation region of K-meson: $K^+ \xrightarrow{p} \varphi$: ● - 32 GeV/c [15] , ▲ - 70 GeV/c [19] ; $K^- \xrightarrow{p} \varphi$: o - 32 GeV/c [17]. Dashed curve - $N_v = 1$, dash-and-dot curve - $N_v = 0$. The solid curve is the total spectrum.



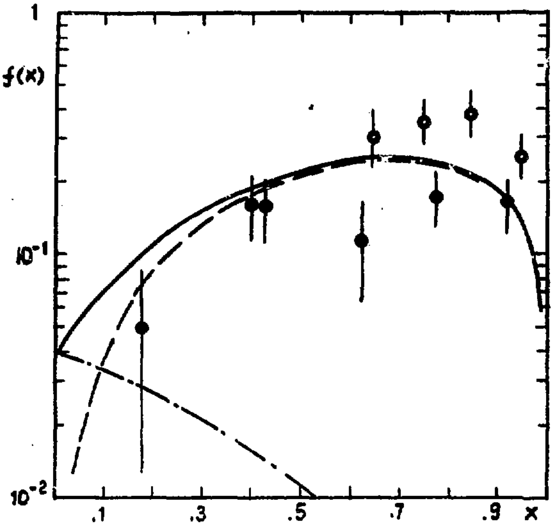


Fig.6 Inclusive spectra of K(1430) mesons in the fragmentation region of kaon.

a) $K^+ \xrightarrow{p} K^+(1430)$; ● - 32 GeV/c [20]; $K^- \xrightarrow{p} K^-(1430)$ ○ - 32 GeV/c [21]: dashed curve - $N_v = 1$ (fragmentation on the strange quark of K-meson), dash-and-dot curve - $N_v = 1$ (fragmentation on the nonstrange quark of K-meson), dash-dot-dot curve - $N_v = 0$. The solid curve is the total spectrum.

b) $K^+ \xrightarrow{p} K^0(1430)$; ● - 32 GeV/c [20]; $K^- \xrightarrow{p} \overline{K^0}(1430)$: ○ - 32 GeV/c [21]. Dashed curve - $N_v = 1$ (on strange quark), dash-and-dot curve - $N_v = 0$. The solid curve is the total spectrum.

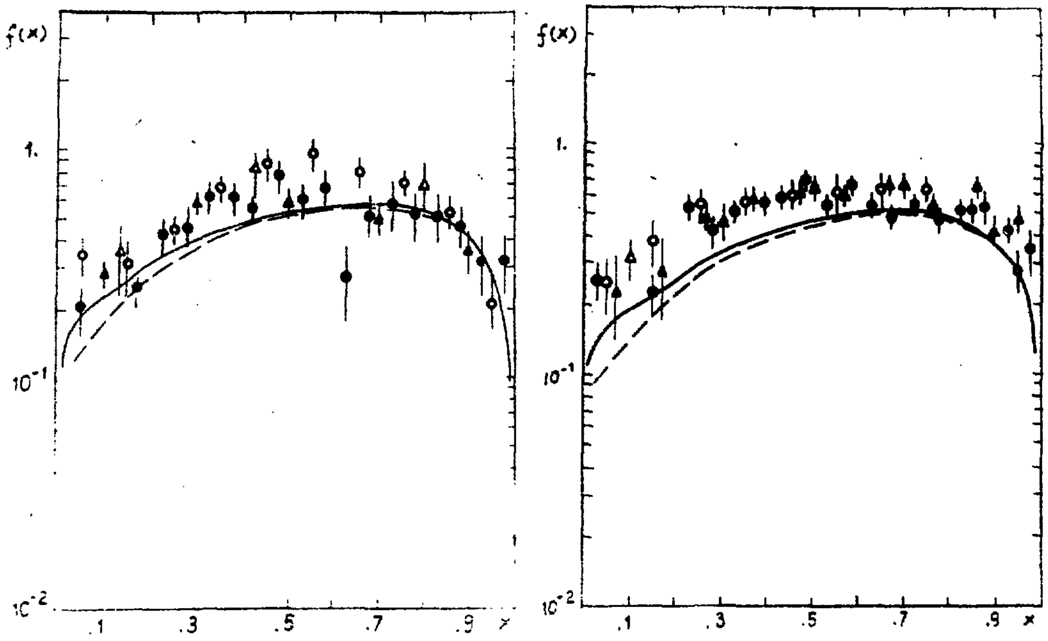


Fig.7 Inclusive spectra of K(890) mesons in the fragmentation region of kaon. The dashed curve is the spectrum of "direct" fragmentation of kaon into K(890). The solid curve is the total spectrum with regard for "direct" fragmentation and decays K(1430) → K(890)π

a) $K^+ \xrightarrow{p} K^+(890)$: ● - 32 GeV/c [22] , ▲ - 70 GeV/c [16]; $K^- \xrightarrow{p} K^-(890)$: ○ - 32 GeV/c [21], △ - 110 GeV/c [18] .

b) $K^+ \xrightarrow{p} K^0(890)$: ● - 32 GeV/c [22] , ▲ - 70 GeV/c [16]; $K^- \xrightarrow{p} \overline{K}^0(890)$: ○ - 32 GeV/c [21], △ - - 110 GeV/c [18] .

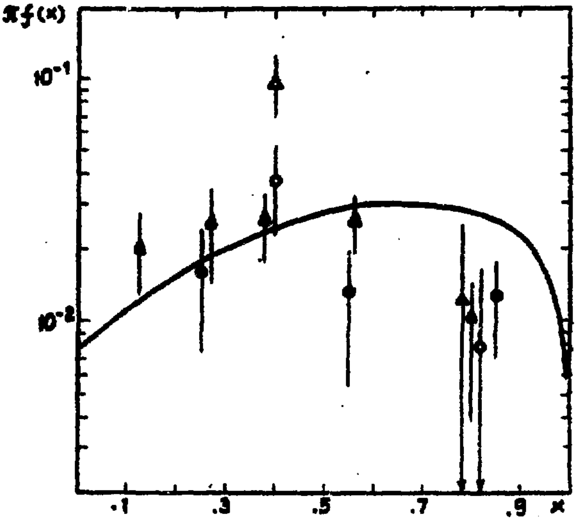


Fig.8 Inclusive spectra $\overline{\Sigma}$ (1385) and Σ(1385) in the fragmentation region of K-meson

$K^+ \xrightarrow{p} \overline{\Sigma}^+(\overline{\Sigma}^-)$: ● (▲) – 32 GeV/c [23] ;

$K^- \xrightarrow{p} \Sigma^-(\Sigma^+)$: ○ (△) – 32 GeV/c [24] .

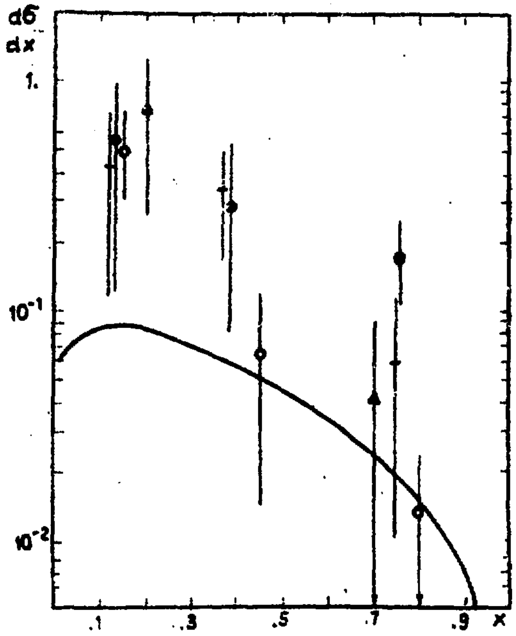


Fig.9 Inclusive spectra of Δ^{++}(1232) in the fragmentation region of K-meson. $K^+ \xrightarrow{p} \Delta^{++}$: ● (+) – 32 GeV/c [25,26] , ▲ – 70 GeV/c [25] ; $K^- \xrightarrow{p} \Delta^{++}$: ○ – 32 GeV/c [24] .

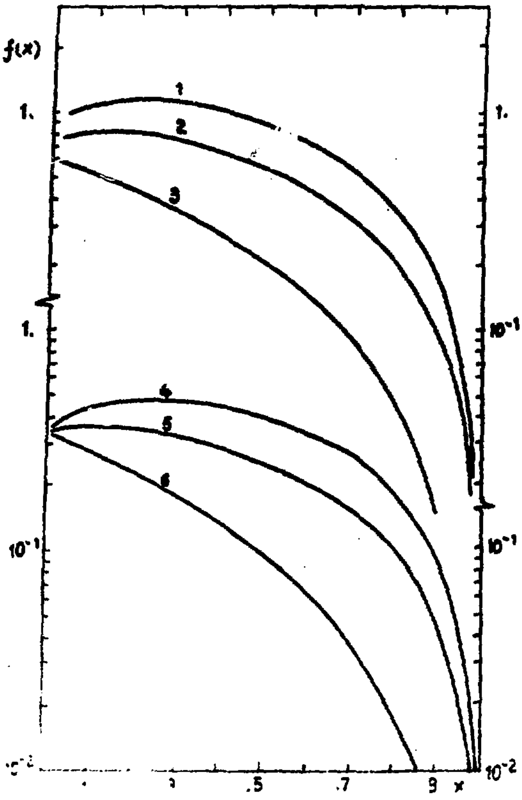


Fig.10 Inclusive spectra of ρ^+ (curves 1,4), ρ^0(curves 2, 5) and ρ^- (curves 3, 6) mesons in the fragmentation regions of π^+ (curves 1,2,3) and K^+ (curves 4,5,6) mesons.

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ИНКЛЮЗИВНЫЕ СПЕКТРЫ АДРОННЫХ РЕЗОНАНСОВ В РАМКАХ МНОГОПАРТОННОЙ РЕКОМБИНАЦИОННОЙ МОДЕЛИ П.ФРАГМЕНТАЦИЯ ПИОНА И КАОНА

(на английском языке, перевод Г.А.Папяна)

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